Effect of Green tea Consumption on Blood Pressure and Serum Lipid Profile of Hypertensive Borderline Dyslipidemic Adults

Dr. Nilufar Yasmin

MBBS. M.Phil.

Senior Lecturer

Department of Physiology

Ad-din Women's Medical College

Blood Pressure

- It is the lateral pressure exerted by blood on unit area of vessel wall while flowing through it.[2]
- Types of blood pressure: [1]

Name of blood pressure	Definition	Normal Range
1.Systolic blood pressure	The maximum pressure during ventricular systole is called systolic blood pressure.	100 -140 mm Hg
2.Diastolic blood pressure	The minimum pressure during ventricular diastole is called diastolic blood pressure.	60 -90 mm Hg
3. Pulse pressure	Difference between systolic and diastolic blood pressure	40-50 mm Hg
4. Mean arterial pressure	Average blood pressure which is calculated as the diastolic pressure plus one third of pulse pressure	78-98 mmHg

Regulation of blood pressure [2]

1. Short term regulation of arterial pressure (within seconds to minutes)	a) Baroreceptor feedback mechanism b) Chemoreceptor mechanism c) Central nervous system ischemic response
2. Intermediate term regulation of blood pressure (within minutes to several hours)	a) Renin-Angiotensin vasoconstrictor mechanism b) Stress relaxation of vasculature c) Capillary fluid shift mechanism
3. Long term regulation of blood pressure (several days to months)	a) Renal body fluid mechanism b) Renin angiotensin aldosterone pressure control mechanism

Hypertension

- Hypertension is the sustained elevation of systemic arterial blood pressure.
- According to National Guideline Blood pressure is classified as the following :[3]

Category	Systolic blood pressure(mm Hg)		Diastolic blood pressure(mm Hg)
Optimal	<120	and	<80
Pre hypertension	120-139	and/or	80-89
Stage 1 hypertension	140-159	and/or	90-99
Stage 2 hypertension	160-179	and/or	100-109
Stage 3 hypertension	≥180	and/or	≥ 110
Isolated systolic hypertension	≥140	and	<90

Etiology of Hypertension

A. Primary or essential- more than 95% cases are idiopathic

B. Secondary- underlying causes are-

i) Obesity

ii) Pregnancy

iii) Renal parenchymal and vascular disease, polycystic disease of kidney

iv) some endocrine diseases like cushing's syndrome, pheochromocytoma, acromegaly, primary hyperaldosteronism, primary hypothyroidism etc. [4]

Dyslipidemia

Dyslipidemia may be defined as increased plasma levels of cholesterol, triglycerides (TGs), or both, variably accompanied by reduced levels of high density lipoprotein cholesterol. [5]

Dyslipidemias are most commonly associated with increased risk of atherosclerotic cardiovascular disease.

Green Tea

Tea is the most widely consumed beverage in the world. There are different forms of tea based on the method of production - black tea (fully fermented), oolong tea (half fermented) and green tea (non fermented) . All the forms are derived from the leaves and buds of the plant *Camellia sinensis.* [7]

Active components of Green Tea:

- **Catechins** constitutes more than 70% of flavonoids of green tea.
- **Epigallocatechin gallate (EGCG) -**the major **Catechin**

❑ Other components-

- caffeine
- theophylline
- carbohydrates
- lipids
- proteins
- amino acids, sterols, minerals
- vitamins (B, C, E)
- trace elements, some volatile aldehyde and ketones etc. [8]

Health benefits of Green Tea

- Green tea improves plasma lipid profile [9]
- Can promote weight loss and have antihypertensive property [10]
- It can also reduce blood glucose [11]

Relation between Green tea and blood pressure

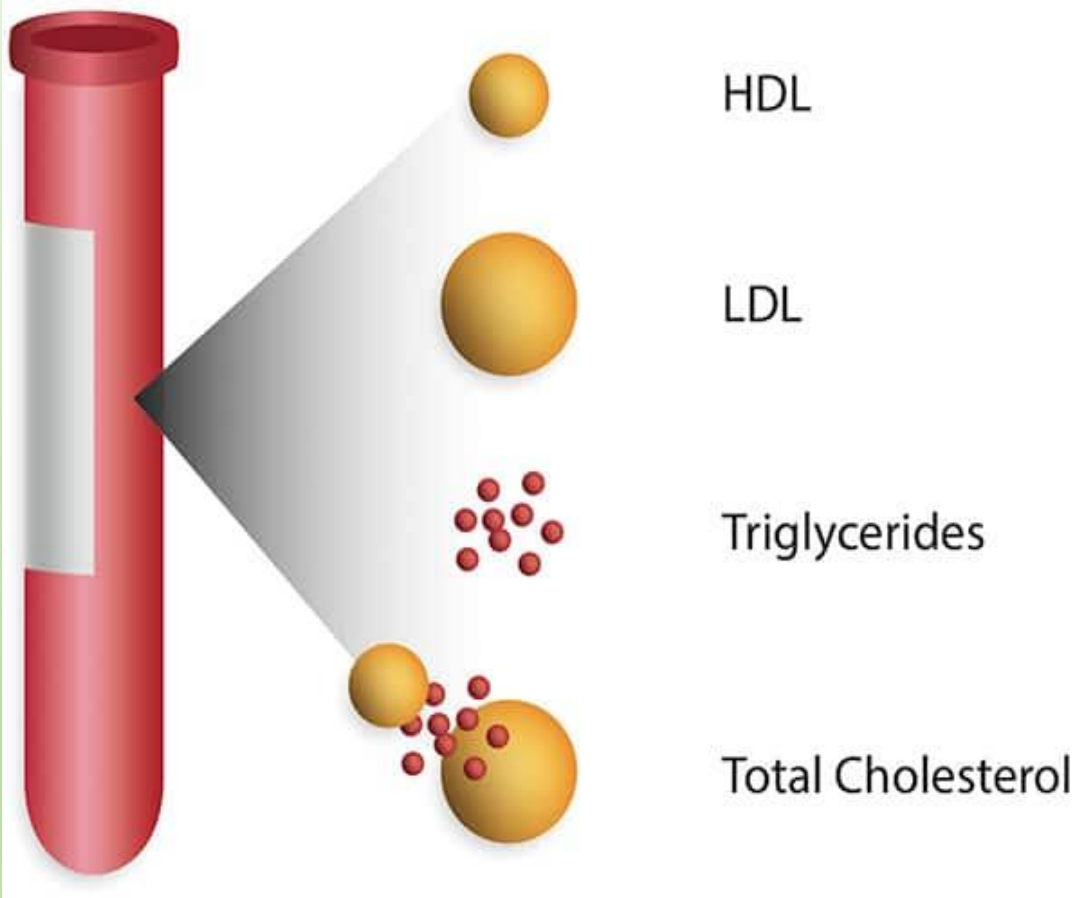
Green tea can reduce blood pressure by the following mechanisms -

a)It can balance vasoconstricting substances like angiotensin II, prostaglandins, endothelin-I and vasodilators like prostacyclin and thereby maintain vascular tone

(b) It can also increase nitric oxide (NO) production from endothelium which is a vasodilator. [12,13,14]

Reference ranges of Serum Lipid Profile: [16]

Name of Lipid	Reference range
Serum total cholesterol(mg/dl)	<200 mg/dl
Serum triglyceride(mg/dl)	53-150mg/dl
Serum HDL-C(mg/dl)	>40 mg/dl
Serum LDL-C(mg/dl)	100-129 mg/dl



Relation between green tea and serum lipid profile :

1. Inhibit the Squalene epoxidase enzyme thus decrease biosynthesis of cholesterol
2. ↓ Intestinal absorption of total cholesterol
3. ↑ fecal excretion of cholesterol. [9,17]

Name of Study: Effect of Green tea on Blood pressure and serum Lipid profile of Hypertensive Borderline Dyslipidemic adults

- Place of study : Department of Physiology, Sir Salimullah Medical College
- Study period: 1/07/2023 to 30/06/2024
- Sample size: Total number of 92 hypertensive dyslipidemic adult subjects both male and female age ranging from 40-60 years were included in this study

Selection Criterias

Inclusion Criteria

I. Age : 40-60 years

II. Gender : Both male and female

III. Controlled hypertensive subjects getting antihypertensive (calcium channel blocker / angiotensin receptor blocker) drug for at least 6 months

IV. With borderline level of one of the following lipid profile:

- Total cholesterol (200-239 mg /dl)
- Triglyceride (150-199 mg/dl)
- Low density lipoprotein cholesterol (LDL-C) (130-159 mg/dl)

Exclusion Criteria

i. Any comorbidities: such as diabetes mellitus, thyroid dysfunction, renal disease, heart disease, stroke, any malignancy, history of liver disorders

ii. History of smoking, alcoholism or any type of addiction

iii. History of taking Atorvastatin, Rosuvastatin or any other lipid lowering drug

Work Plan

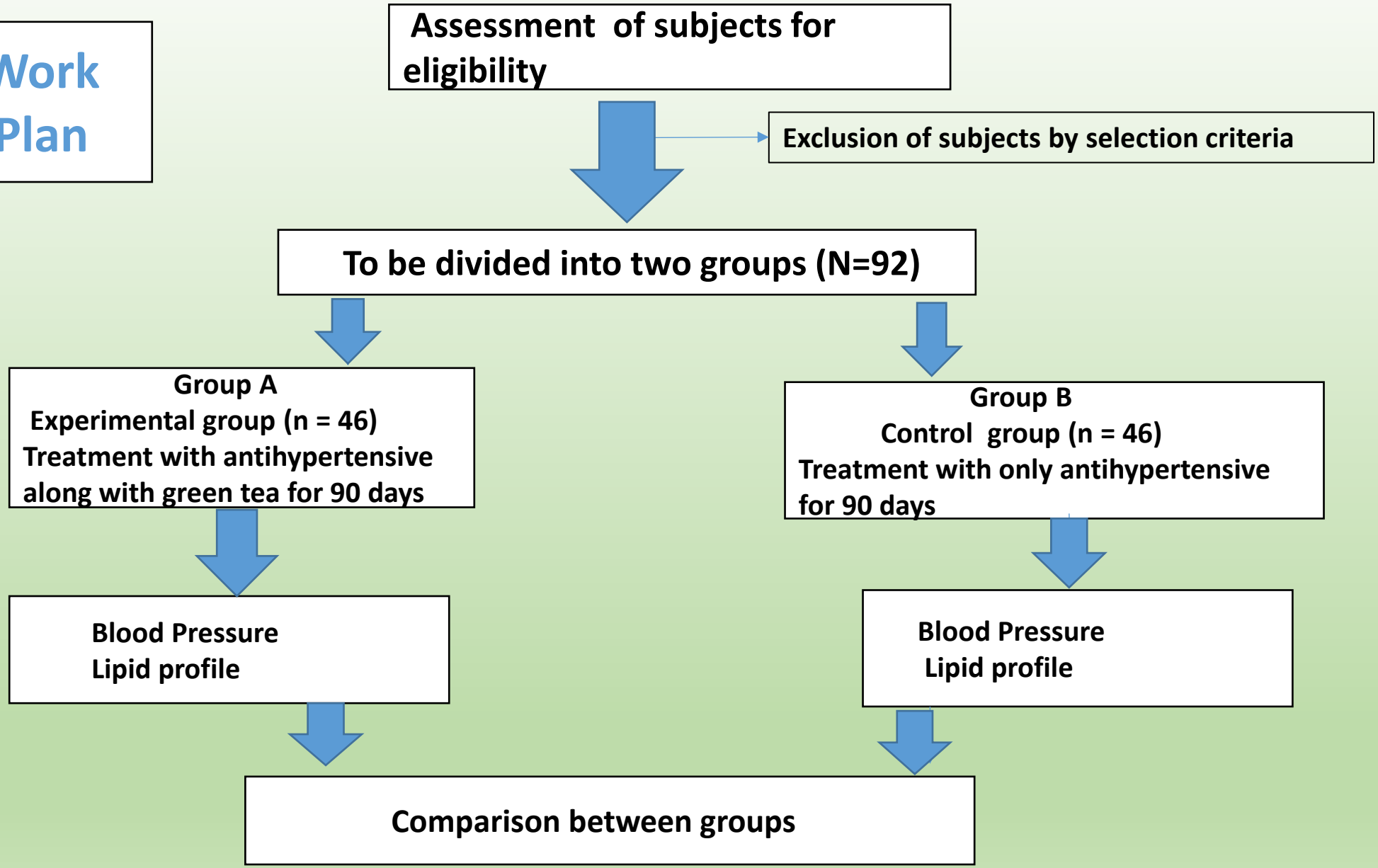
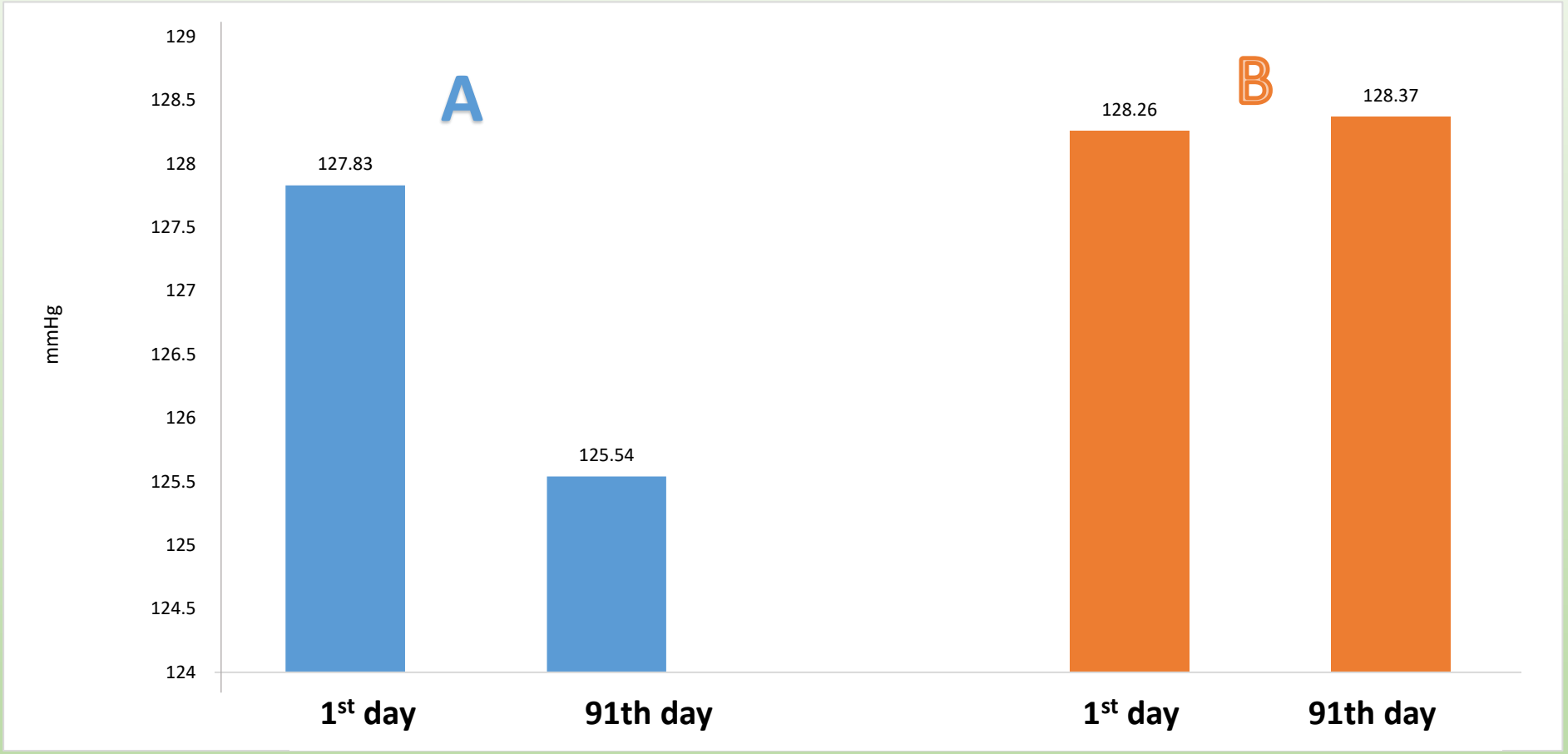

Assessment of subjects for eligibility
Exclusion of subjects by selection criteria
To be divided into two groups (N=92)
Group A
Experimental group (n = 46)
Treatment with antihypertensive along with green tea for 90 days
Group B
Control group (n = 46)
Treatment with only antihypertensive for 90 days
Blood Pressure
Lipid profile
Blood Pressure
Lipid profile
Comparison between groups

Figure 1

Mean systolic blood pressure of the subjects in groups before and after intervention (N=92)



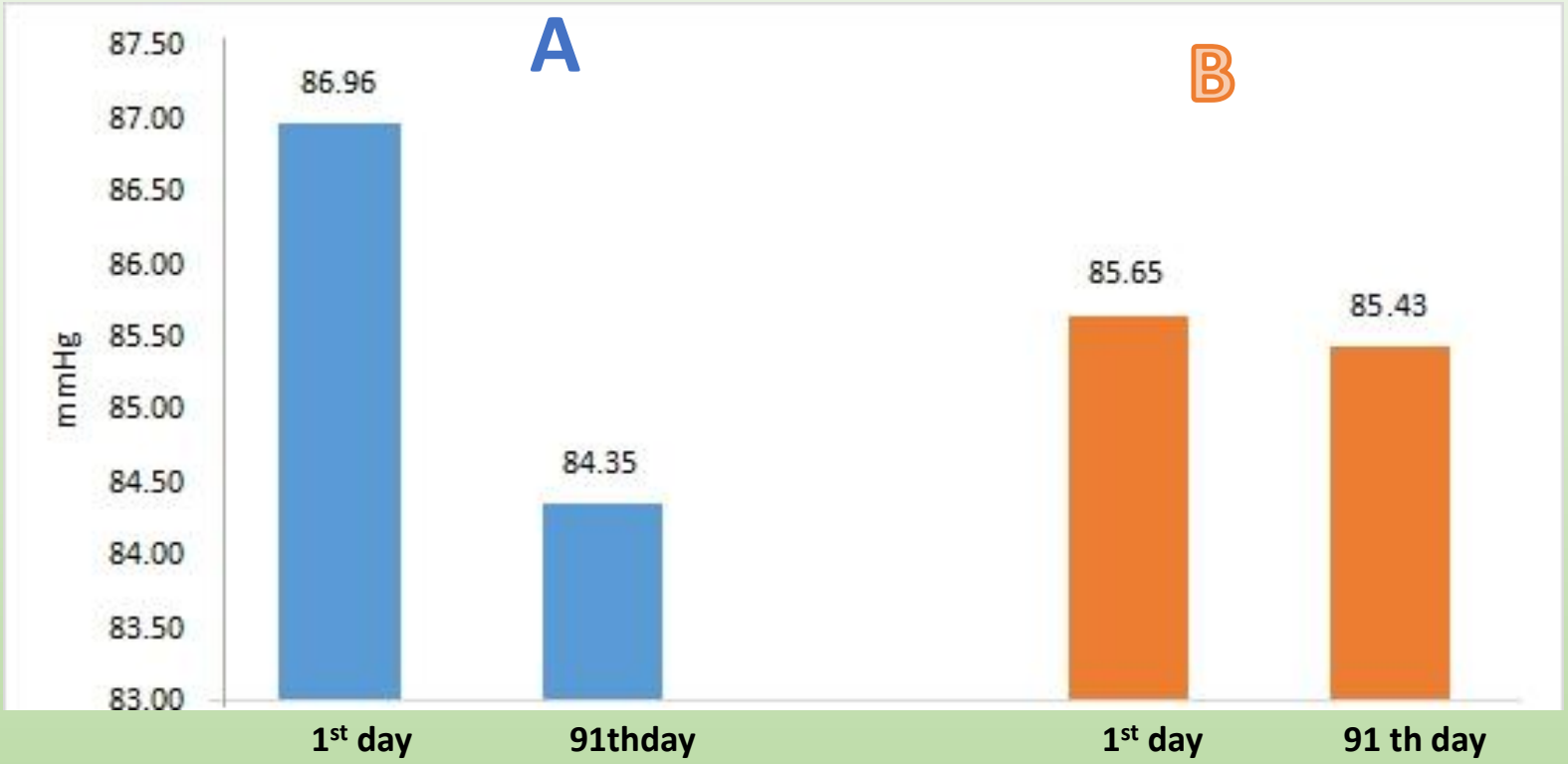
A: Experimental group (treatment with antihypertensive along with green tea consumption for 90 days)

B: Control group(treatment with antihypertensive drug for 90 days)

N= Total number of the study subjects

Figure 2

Mean diastolic blood pressure of the subjects in groups before and after intervention (N=92)

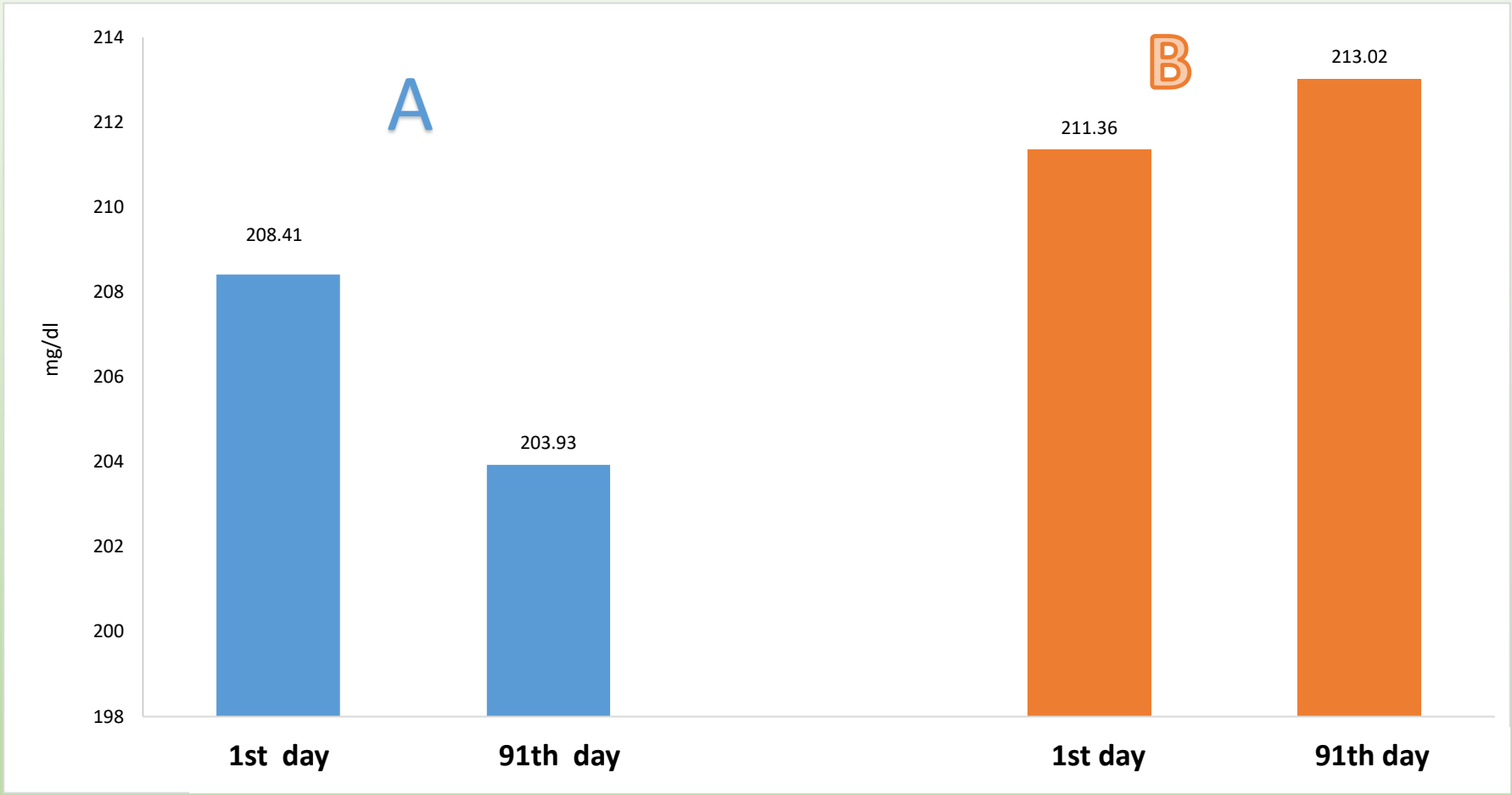


A: Experimental group (treatment with antihypertensive drug along with green tea consumption for 90 days)

B: Control group (treatment with antihypertensive drug for 90 days)

N= Total number of the study subjects

Figure 3
Mean serum total cholesterol level of the subjects in different groups (N=92)

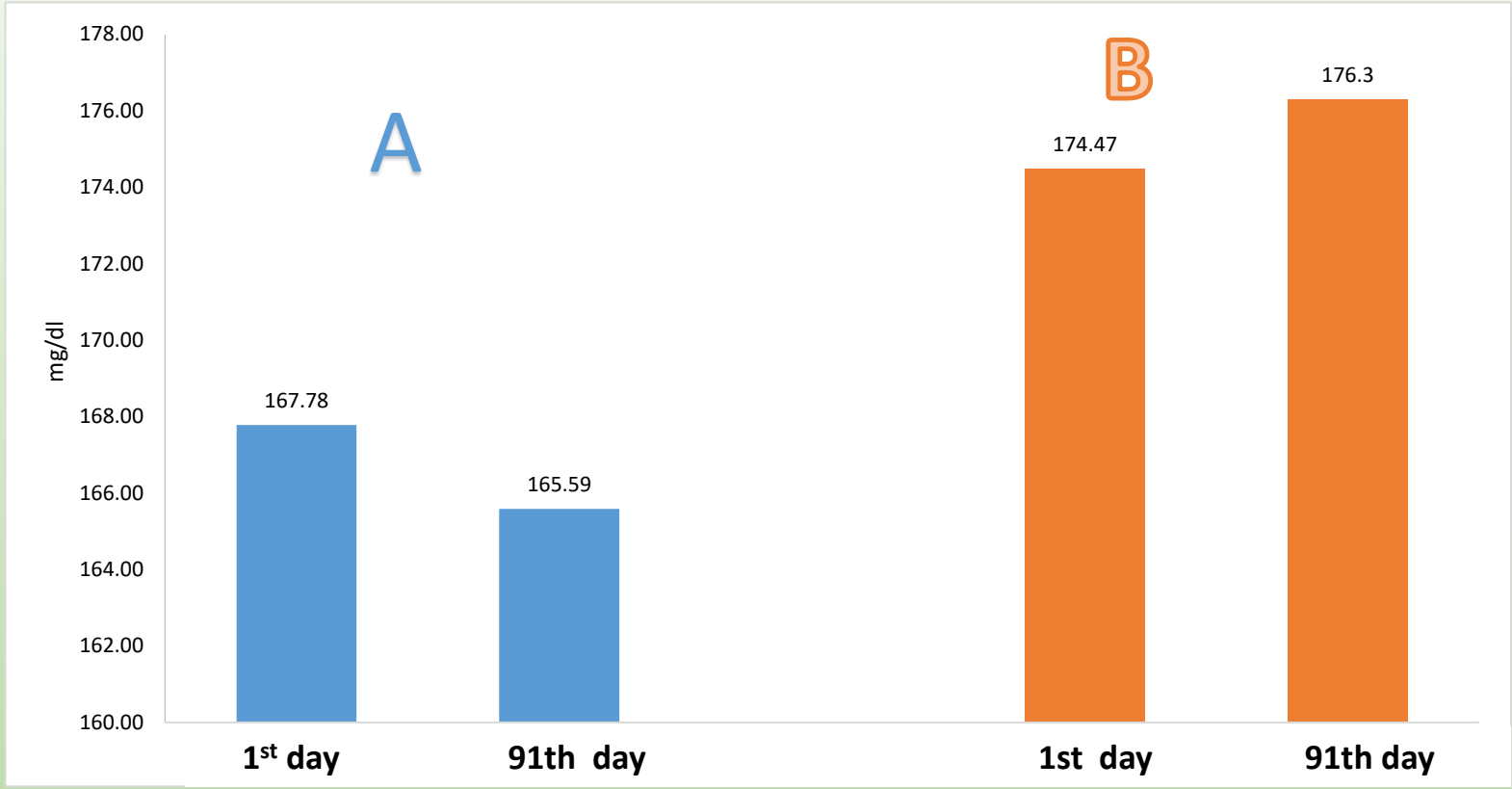


A : Experimental group (treatment with antihypertensive drug along with green tea consumption for 90 days)

B: Control group (treatment with antihypertensive drug for 90 days)

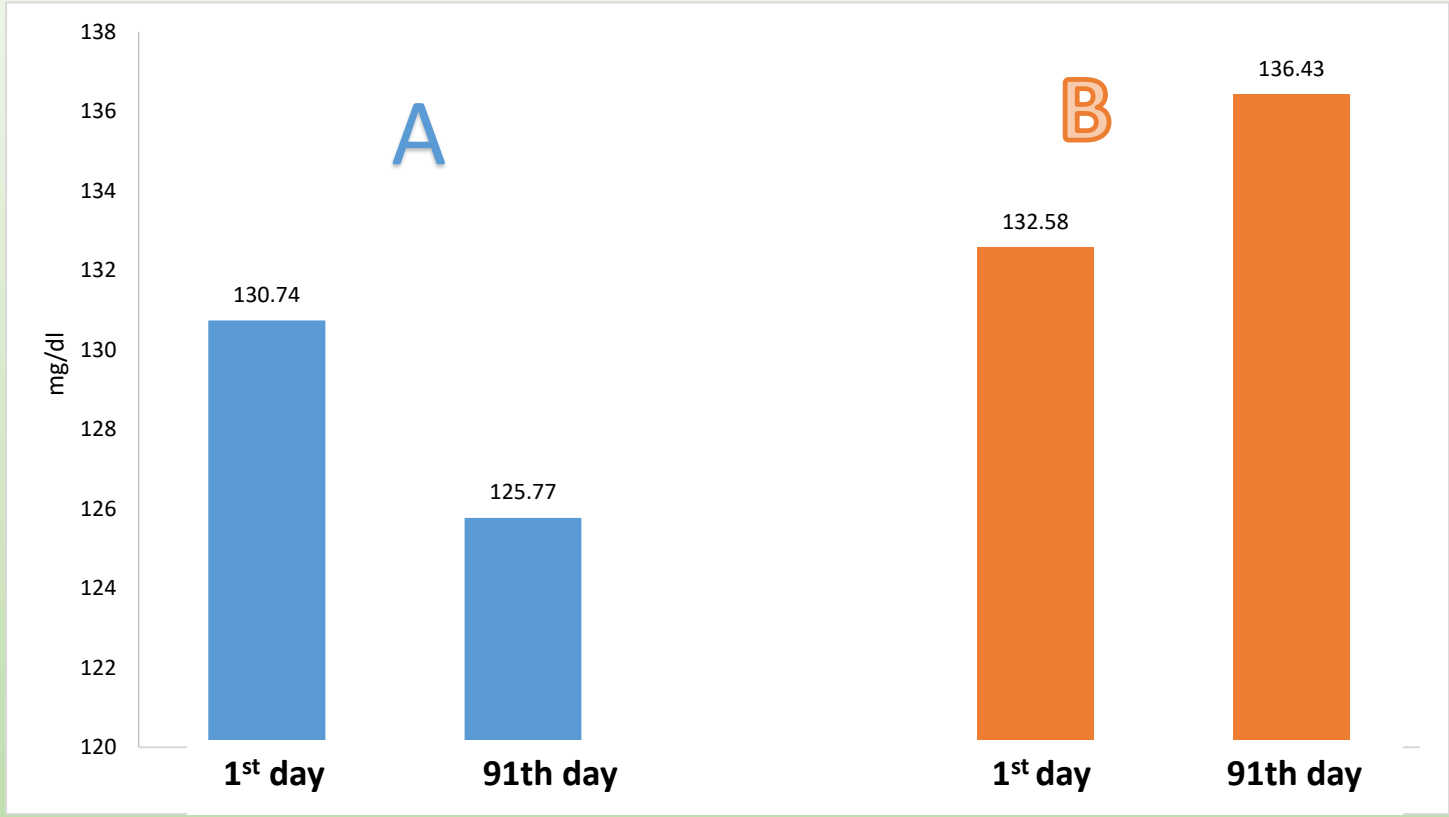
N= Total number of the study subjects

Figure 4
Mean serum triglyceride level of the subjects in different groups (N=92)



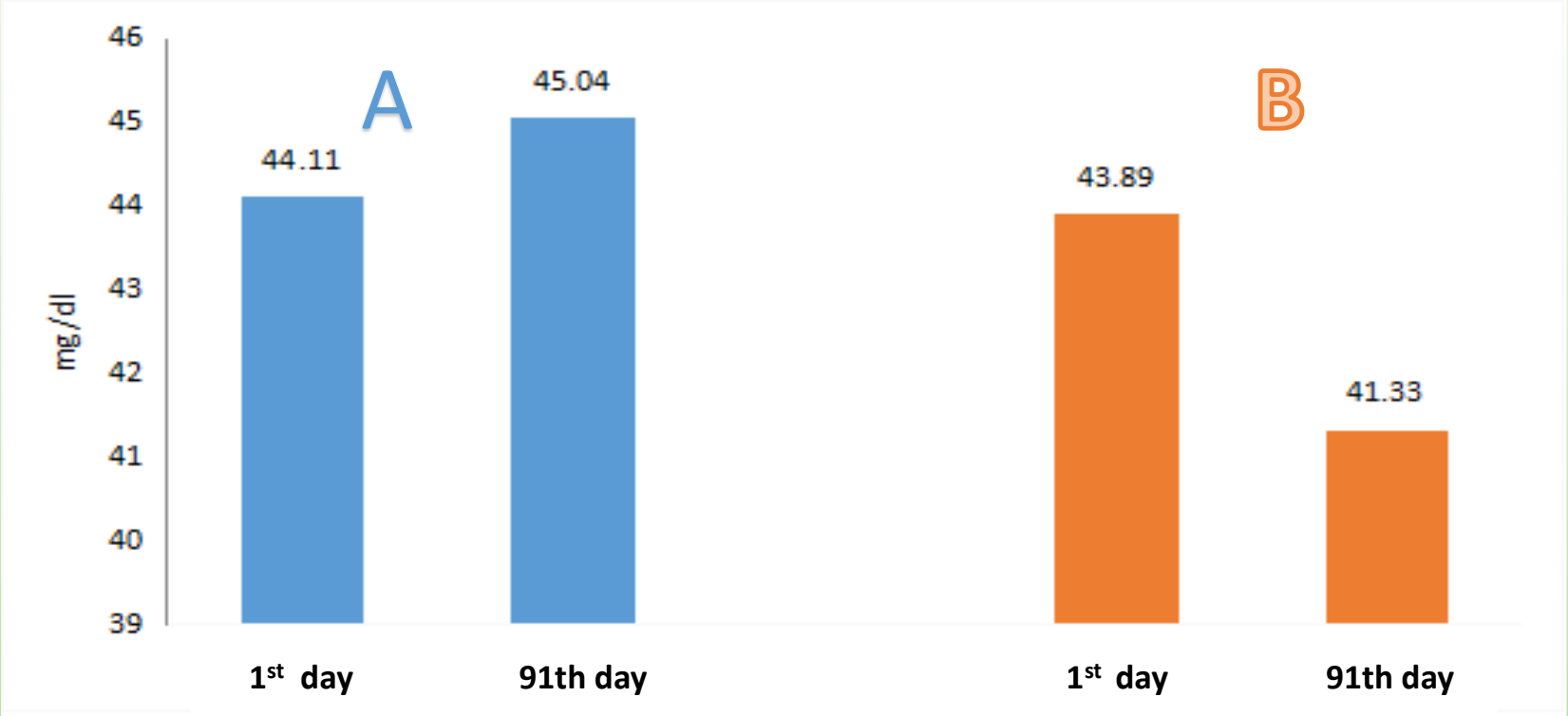
A : Experimental group (treatment with antihypertensive drug along with green tea consumption for 90 days)
B: Control group (treatment with antihypertensive drug for 90 days)
N= Total number of the study subjects

Figure 5
Mean serum LDL level of the subjects in different groups (N=92)



A : Experimental group (treatment with antihypertensive drug along with green tea consumption for 90 days)
B: Control group (treatment with antihypertensive drug for 90 days)
N= Total number of the study subjects

Figure 6
Mean serum HDL level of the subjects in different groups (N=92)



A : Experimental group (treatment with antihypertensive drug along with green tea consumption for 90 days)
B: Control group (treatment with antihypertensive drug for 90 days)
N= Total number of the study subjects

CONCLUSION

It is concluded that green tea consumption is effective to reduce systolic and diastolic blood pressure. It can also decreases serum levels of total cholesterol, triglyceride, low density lipoprotien cholesterol and increases serum high density lipoprotien cholesterol level in hypertensive borderline dyslipidemic adult individuals.

LIMITATION

- The phytochemical study of green tea was not done so the amount of catechin present in green tea from different variants couldn’t be compared.
- Most of the samples were taken from different areas of Dhaka city not from other districts. So, the study did not represent the whole country.

References

1.Barrett, K. E., Barman, S.M., Brooks , H. L., & Yuan, J. X. J., 2019. *Ganong's Review of Medical Physiology.* 26th ed. New Delhi : Tata McGraw Hill Companies, inc, p. 568.

2.Hall, J. E. & Hall, M. E. 2021 . *Guyton and Hall Textbook Of Medical Physiology.* 14th edition, Philadelphia, Elsevier., pp .205-209, 213-225

3.Malik, A., Khandaker, R. K., Zaman, M. M., Choudhury, S. R., (ed). 2013. National Guideline For Management of Hypertension. DGHS,Ministry of Health and family Affairs (https://www.researchgate.net/publication/325710111)

4.Mather A., Sullivan D. R. & Miller-Hodges E., 2022 .Clinical biochemistry and metabolic medicine, In: Ian D Penman I. D., Ralston S. H., Strachan M. W. J. & Hobson R. P. (eds) *Davidson's Principles and Practice of Medicine*, 24th edition, Philadelphia, Elsevier, pp. 634-640.

5.Rader, D.J., Kathiresan, S., 2018 . Disorders of Lipoprotien metabolism. *Harrisons Principles of Internal Medicine*. 20th ed. Mcgraw-Hill Education. United States. pp.2889-2902.

6.Sesso, H.D., Buring,J.E.,Chown, M.J., Ridker, P.M., Gaziano,J.M.,2005. A prospective study of plasma lipid levels and Hypertension in Women. *Arch Intern Med*. Vol 165.pp .2420-27.

7.Parmar, N., Rawat, M., Kumar, J.V., 2012. Camellia Sinensis (Green Tea) : A Review. *Global Journal of Pharmacology.* Vol 6 (2) pp .52-59.

8.Chacko, S.M., Thambi, P.T., Kuttan, R. Nishigaki, I., 2010. Beneficial effects of green tea: a literature review. *Chin Med 2010.* Vol 5, p. 13.

9.Zheng, X.X., Xu,Y.l., Li, S.H.,Liu, X. X., Hui, R.,Huang, X. H., 2011. Green tea intake lowers fasting serum total and LDL cholesterol in adults: a meta-analysis of 14 randomized controlled trials.*Am J clin Nutr,* Vol 94, pp. 601-610.

10.Basu, A., Sanchez. K., Levya, M, J., Wu, M., Betts, N. M., Aston, C. E., Lyons, T. J., 2010. Green Tea Supplementation Affects Body Weight, Lipids and Lipid Peroxidation in Obese Subjects with Metabolic Syndrome. *Journal of the American College of Nutrition*. Vol 29 (1), pp. 31-40.

11. Tsuneki, H., Ishizuka,M.,Terasawa, M.,Wu, J.B. Sasaoka, T.,& Kimura, I., 2004. Effect of green tea on blood glucose levels and serum proteomic patterns in diabetic (db/db) mice and on glucose metabolism in healthy humans.*Bio Med Central.*Vol 4.p.18.

12. Peng, X., Zhou, R., Wang, B., Yu, X., Yang, X., Liu, K., Mi, M., 2014. Effect of green tea consumption on blood pressure: A meta-analysis of 13 randomized controlled trials. *Scientific reports.* Vol 4, pp .1-7. doi: 10.1038/srep 06251.

13.Schiffrin, E. L., 2001. A critical review of the role of endothelial factors in the pathogenesis of hypertension. *Journal of cardiovascular pharmacology*. Vol 38.pp. 3-6

14.Potenza, M.A., Marasciulo, F .L., Taraquinio, M., Tiravanti, E.,2007.EGCG,a green tea polyphenol,improves endothelial function and insulin sensitivity,reduces blood pressure and protects against

myocardial I/R injury in SHR. *Endocrinology and metabolism.* Vol.292. pp.1378-87 //https//doi.org/10.1152/ajpendo.00698.2006

15.Bhardwaj, P., Khanna, D., 2013.Green tea catechins: defensive role in cardiovascular disorders. *Chinese Journal of Natural Medicines*. Vol 11, pp.345-353.

16.Jenks, S.J. 2022. Laboratory reference ranges,In: Penman,I.D., Ralston,S.H., Strachan,M.W., Hobson, R.P., (eds) *Davidson's Principles & Practice Medicine*,24th edition, Philadelphia, Elsevier, p. 1312.

17. Bursill, C.A., Abbey, M., Roach, P.D., 2006. A green tea extract lowers plasma cholesterol by inhibiting cholesterol synthesis and upregulating the LDL receptor in the cholesterol-fed rabbit. *Atherosclerosis.*Vol 193, pp.86-93. doi: 10/1016/ j.atherosclerosis.2006.08.033

18.Raederstroff, D. G., Schlachter, M. F., Elste, V., Weber, P., 2003. Effect of EGCG on lipid absorption and plasma lipid levels in rats. *J Nutr Biochem*. Vol 14, pp. 326-332

THANK YOU